RESEARCH CIRCULAR 194 AUGUST 1973

Evaluation of Ohio Dairy Feeding Rations

H. M. KEENER
H. R. CONRAD

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
Wooster, Ohio

CONTENTS

* * * *

Introduction 3

Selection of Feed Ration 3

Selecting a Feeding Program 4

Results of Analysis 5

- Low Feed Cost, All Feeds 5
- High Feed Cost, All Feeds 5
- Feed Cost Level M, All Feeds 5
- Restrictions on Feeding Programs 5
- Cow Size 7
- Butterfat Test 7
- Herd Size 7
- Milk Production 7
- Constraints 8

Summary 8

References 9

Appendix 10

- Appendix Table I.—Cost of Storing and Feeding Crops 10
- Appendix Table II.—Cost of Feeds in Ohio 10
- Appendix Table III.—Nutrient Value, Cost of Feeds Used in Analysis 11
- Appendix Tables IV—XVII.—Selected Feeding Programs for 20 and 100-Cow Herds 12-16

8-73-2.5M

Evaluation of Ohio Dairy Feeding Rations

H. M. KEENER and H. R. CONRAD

INTRODUCTION

Production of milk at the highest profit is the goal of most dairymen. This requires providing feed and surroundings which will allow each cow to produce milk at its highest inherited capacity. Within dairy breeds, restrictions on the amount of feed eaten set the most important limits on milk production. These limitations arise from the chemical (lignin content) and physical (coarseness of structure) characteristics of the plants in the ration, the total amounts fed, and the size and heat production of the cow.

This report describes some of the restrictive limits in feeding dairy cows, integrates these feeding principles with labor and other economic conditions into a total feeding system, and solves with the aid of a computer least cost feeding programs (8).

SELECTION OF FEED RATION

In choosing a feed ration, not only is the nutrient content of the feeds important, but also digestibility, hay to grain ratio, feed level above maintenance, and palatability of feeds. The nutrient requirements of dairy cows have been tabulated (13, 14, 16). These tabulated values were used to derive prediction equations for the animals' digestible energy, total protein, calcium, phosphorus, and salt needs. In these equations, actual body weight was used instead of metabolic size. The error resulting from the approximation is less than 1% for the range 800 lb. to 1800 lb.

The resulting equations are:

$$DE = 2.5 + .014W + 5.6DW + (.254 + .116BF)\,SM \quad (1)$$

$$TP = 0.3 + .001W + 0.6DW + (.046 + .008BF)\,SM \quad (2)$$

$$CA = 0.015 + .000025W + (.0019 + .0002BF)\,SM + .0352DW \quad (3)$$

$$PH = 0.009 + .000021W + (.0012 + .0002BF)\,SM + .0308DW \quad (4)$$

$$SA = 0.055 + 0.0015SM \quad (5)$$

where DE = digestible energy, Mcal/day
TP = total protein, lb./day
CA = calcium, lb./day
PH = phosphorus, lb./day
SA = salt, lb./day
W = body weight of cow, lb.
DW = daily body weight gain, lb.
SM = daily milk production, lb.
and BF = percent butterfat in milk.

In the analysis, digestible energy was used instead of net energy, since most feed substances are evaluated on the basis of total digestible nutrients (TDN). One pound of TDN is equivalent to 2.2 Mcal of digestible energy.

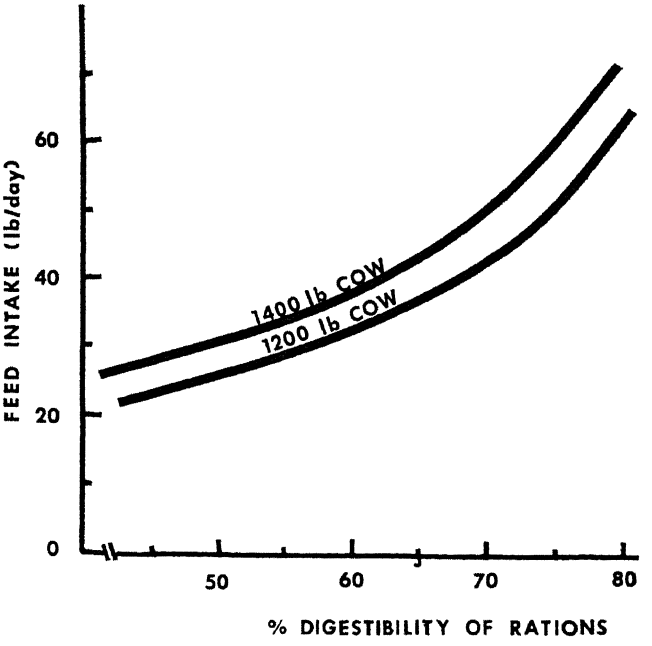

FIG. 1.—Feed intake vs. cow size and digestibility of the ration.

Limits on feed intake due to digestibility of the ration have been studied by Conrad (4). In experiments on voluntary feed intake and digestibilities of feed on 82 Jersey and Holstein cows, it was found that small breeds need rations of highest digestibility to produce at "a level commensurate with their inherited capacity." Data in Figure 1 show how digestible dry matter of the ration affects the level of feed intake for cow sizes of 1200 lb. and 1400 lb. The estimated non-digestible dry matter which a cow can consume per day is given by

$$NDM = 5.4W/500 \quad (6)$$

where NDM = non-digestible dry matter intake, lb./day.

Results of research by Wagner and Loosli (16) suggest that as cows are fed for higher production, the efficiency of digestion in the animal decreases below that at maintenance levels. Also, as grain increases in the ration, efficiency of digestion for the total ration is below what would be calculated from the feeds separately. Their results are summarized in Figure 2. With these results, calculations can be made on how much more needs to be fed to have the ration supply all of the cow needs for maintenance, milk production, and body weight gain. However, when feeds such as corn silage are fed, difficulty arises in

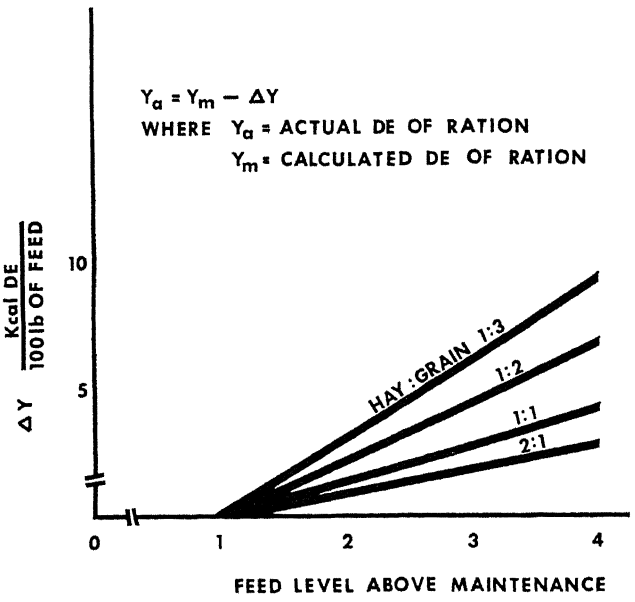

FIG. 2.—Decrease in digestible energy of ration as function of feeding level.

calculating hay to grain ratios. Thus, digestible energy depression was calculated as a function of feeding level above maintenance and the ratio of digestible energy to fiber in the ration. The equation derived by fitting curves to the data of Wagner and Loosli is:

$$Y_a = Y_c - .044\,(X - 1)\,x\,(1 - 1/\exp\,(1 - 25b)^2) \qquad (7)$$

where Y_a = actual digestible energy of ration, Mcal
Y_c = calculate digestible energy of ration, Mcal
X = feed level above maintenance
and b = Y_c divided by pounds of fiber in ration.

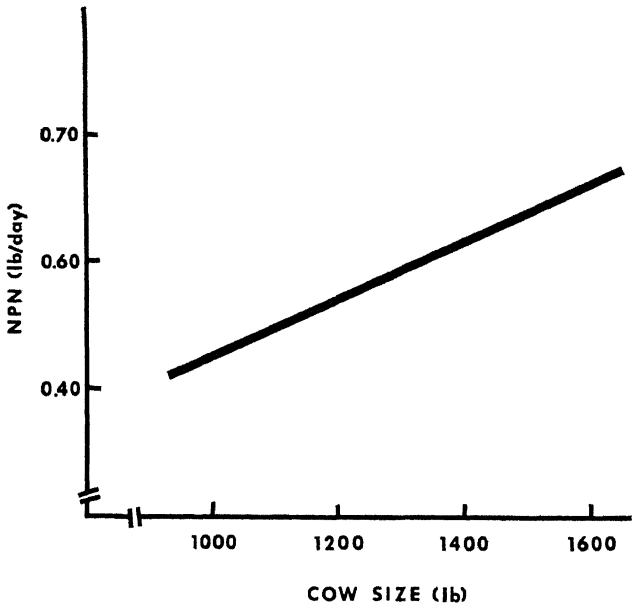

FIG. 3.—Maximum allowable non-protein nitrogen in dairy cow rations.

Because of the limited data used in deriving this equation, it is only an estimator of what will happen to digestibility as Y_c and b vary. This equation estimated that the actual DE dropped about 1.5% for each 10 lb. of milk above 40 lb. of milk per day in the rations selected in this analysis. This is in agreement with the recommendation that a 3% feed allowance be made for each 10 kg. of milk produced above 20 kg. (14). Adjustment of the ration to compensate for this depression in DE was added to the computer program used in the analysis.

When considering palatability of the feed, a major area of concern is in using urea. Safe limits on urea or non-protein nitrogen (NPN) in the diet have been set and are shown in Figure 3. Guidelines on conditions under which urea has successfully been used are summarized by Conrad, *et al. (2)*. Their results indicated 10 lb. of urea per ton of corn silage could be fed with no decrease in feed intake. Also, the National Research Council suggests that urea should not exceed 1% of the dry concentrates fed, as amounts exceeding this limit decrease the intake of concentrates (14).

Fiber content of the ration has been found to have a significant effect on the production of milk with a normal butterfat percentage. Results (11) indicate that the fiber content of a feed ration should range between 15% and 25%.

Other considerations of the feeding ration are types of acids in the silage, length of cut of roughage, and frequency of feeding and manner of feeding (all feeds together or separately). These concerns are discussed extensively by McCullough (11).

SELECTING A FEEDING PROGRAM

Feed selection is a function of cow size, milk production, feed costs, type of storage, labor costs of moving feed from storage to the cow, handling equipment costs, and feed equipment costs, as well as the hidden losses of spoilage or waste resulting from the type of system chosen (10). A schematic representation of this is shown in Figure 4. For each cow size, milk production level, and herd size, a ration is chosen which meets the cow's nutritional requirements and at the same time is low in cost.

To select feeding programs, a computer program was developed which calculated nutrient requirements as a function of milk production and body size and also as a function of feeding level above maintenance and digestibility of the ration. A further step performed by the program was to incorporate additional costs of labor, storage loss, etc., into the total feed costs as amounts fed and herd size changed.

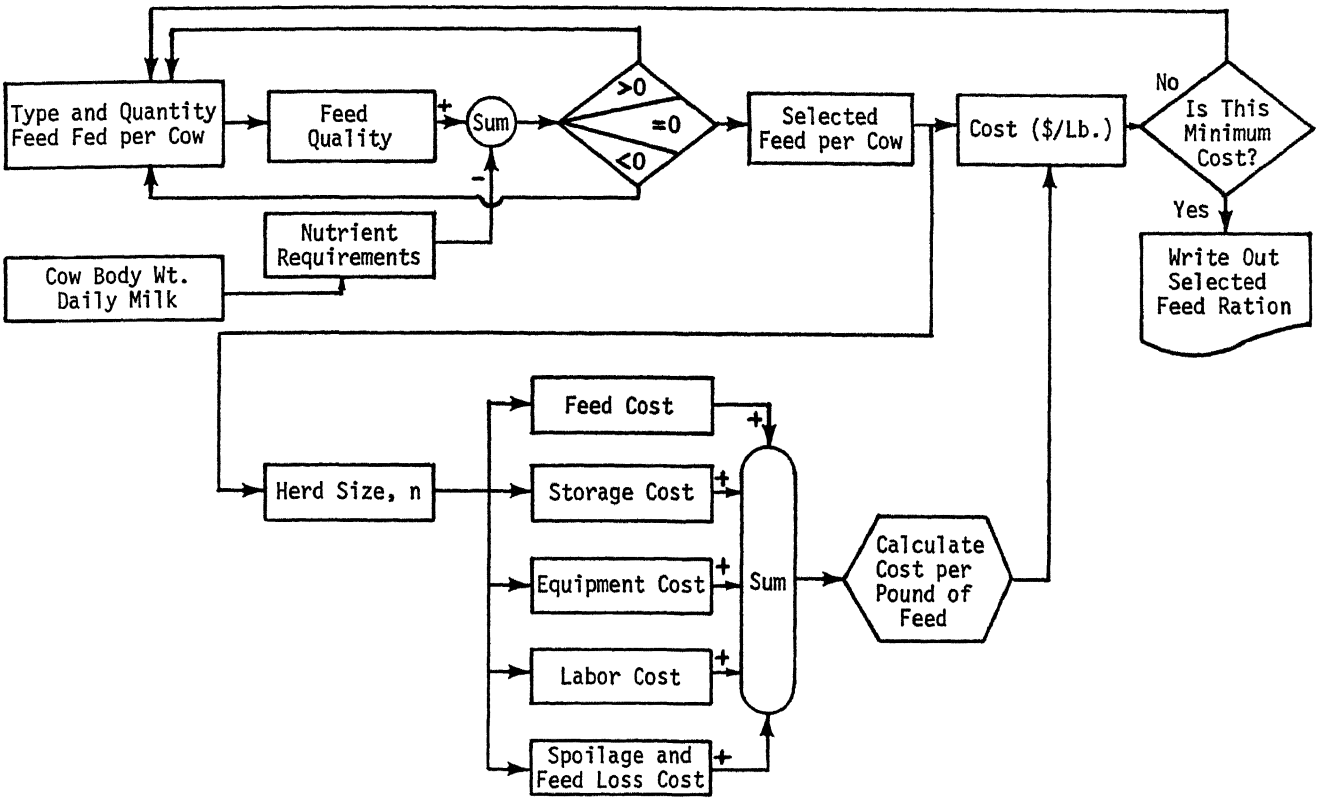

FIG. 4.—Selection of feeding program.

RESULTS OF ANALYSIS

To perform the analysis, different types of feeds and feeding systems were chosen based on current practices in Ohio. The different feed systems and three levels of feed costs used are given in Table 1. The low (L) and high (H) cost levels were based on labor and crop production costs in Ohio and reflect all expenses of getting the crop produced and into storage. The third cost level (M) was based on prices paid to Ohio farmers in 1970. Detailed cost data and nutritional values of feeds are included in the Appendix.

Low Feed Cost, All Feeds

For milk production levels below 60 lb., results indicated the least cost feeding program for herds with more than 34 cows would consist of corn silage stored in a horizontal structure, alfalfa hay stored in a feeding barn, and ear corn (or shelled corn). For herds of 20 animals, alfalfa hay and shelled corn (or corn and cob meal) stored in a vertical silo were found to give the lowest cost feeding programs. Daily costs with no restrictions on available feeds are given in Table 2, and the selected feeding program is given in the Appendix.

High Feed Cost, All Feeds

Results at the higher feed cost level indicated that the least cost program consisted of shelled corn (or corn and cob meal) stored in a vertical silo and alfalfa hay stored in a feeding barn for herd sizes of more than 20 cows. Daily costs are given in Table 2, and the selected feeding program is given in the Appendix.

Feed Cost Level M, All Feeds

Feeding programs selected on the basis of market prices paid to Ohio farmers consisted of alfalfa hay, wheat, ear corn, and some corn silage. The amount of wheat selected for use in the rations ranged as high as 40 lb. per day for the 1400 lb. cow producing 100 lb. of milk per day. This ration meets the cow's nutritional needs but could upset the fermentation process in the rumen if the grain and hay are not fed together. Daily costs are given in Table 2, and the selected feeding program is given in the Appendix.

Restrictions on Feeding Programs

To test for different feeding situations, restrictions were imposed on quality of alfalfa hay available, availability of shelled corn, availability of urea, and availability of ear corn. The daily feed costs for high, low, and M feed costs are given in Table 2 for 100-cow herds. Results for 34-cow herds were slightly higher, but showed the same trends.

At low feed cost, the restrictions of no-shelled corn increased daily feed costs, while hay quality limited to 13.6% protein did not as long as urea was

TABLE 1.—Feeds Used in Analysis.

No.	Feed*		Storage System	Cost per Pound† Low (L)	High (H)	Market (M)
				$/lb.	$/lb.	$/lb.
2	Alfalfa Hay (22% protein)	S4	Hay barn, adjacent bunk, hand fed	0.0090	0.0135	0.0157
3	Alfalfa Hay (18% protein)	S4		0.0075	0.0112	0.0140
4	Alfalfa Hay (13.6% protein)	S4		0.0075	0.0100	0.0129
5	Alfalfa Silage (17.7% protein	S5	Upright silo, silo unloader, mechanical feeder, feed bunk	0.0070	0.0140	0.0150
6	Corn Silage	S5		0.0069	0.0138	0.0150
7	Corn Silage	S6	Bunker silo, tractor and scoop, unloading wagon, feed bunk	0.0069	0.0138	0.0150
8	Corn, Ear (dry)	S2	Flat storage, mixer and grinder, bulk bin and auger	0.0149	0.0169	0.0223
9	Corn, Ear (silage)	S5		0.0120	0.0149	0.0223
10	Corn Grain (dry)	S2		0.0164	0.0191	0.0269
11	Corn Grain (silage)	S5		0.0147	0.0164	0.0269
12	Wheat	S2		0.0220	0.0360	0.0257
13	Soybean, Seed	S2		0.0310	0.0546	0.0513
14	Soybean Oil Meal	S1	Bulk bin and auger	0.0600	0.0600	0.0600
15	Urea, G		Fed in concentrate	0.0553	0.0553	0.0553
16	Urea, S		Fed in corn silage	0.0553	0.0553	0.0553
17	Dicalcium Phosphate		Fed in concentrate	0.0677	0.0677	0.0677
18	Salt		Fed in concentrate	0.1000	0.1000	0.1000

*For nutrient contents, see Appendix Table III.
†Dry matter basis.

TABLE 2.—Daily Cost of Selected Feeding Programs.*

Cow Size, Lb. / Milk Production		1200 Lb.					1400 Lb.					1600 Lb.				
		0	25	50	75	100	0	25	50	75	100	0	25	50	75	100
Cost	Run†	Daily Cost $/Cow/Day					Daily Cost $/Cow/Day					Daily Cost $/Cow/Day				
L	0	0.24	0.35	0.51	0.79	1.09	0.25	0.36	0.50	0.75	1.02	0.28	0.38	0.52	0.72	0.99
	1	0.24	0.35	0.56	0.83	1.10	0.25	0.37	0.54	0.80	1.06	0.28	0.39	0.54	0.78	1.05
	2	0.24	0.35	0.51	0.80	1.09	0.25	0.36	0.50	0.76	1.05	0.28	0.38	0.52	0.71	1.01
	3	0.24	0.35	0.51	0.80	1.09	0.25	0.37	0.52	0.75	1.05	0.28	0.39	0.53	0.71	1.01
	4	0.24	0.35	0.51	0.79	1.23	0.25	0.37	0.52	0.75	1.04	0.28	0.39	0.53	0.71	1.00
	5	0.24	0.35	0.51	0.87	1.32	0.25	0.37	0.52	0.77	1.12	0.28	0.39	0.53	0.71	1.05
	6	0.24	0.40	0.58	0.82	1.23	0.25	0.39	0.59	0.79	1.07	0.28	0.41	0.60	0.80	1.05
H	0	0.29	0.48	0.70	0.97	1.32	0.31	0.51	0.72	0.97	1.25	0.34	0.54	0.75	0.98	1.25
	1	0.29	0.48	0.70	0.97	1.33	0.31	0.51	0.72	0.97	1.25	0.35	0.54	0.75	0.98	1.25
	2	0.29	0.48	0.70	0.95	1.32	0.31	0.51	0.72	0.97	1.25	0.34	0.54	0.75	0.98	1.23
	3	0.29	0.48	0.70	0.95	1.32	0.31	0.51	0.73	0.96	1.25	0.34	0.54	0.75	0.98	1.23
	4	0.29	0.48	0.72	1.13	2.02	0.31	0.51	0.73	1.02	1.32	0.34	0.54	0.75	1.02	1.32
	5	0.29	0.48	0.83	1.43	2.25	0.31	0.51	0.75	1.15	1.74	0.34	0.54	0.75	1.08	1.46
	6	0.29	0.49	0.76	1.27	2.05	0.31	0.52	0.76	1.08	1.41	0.35	0.55	0.76	1.07	1.41
M	0	0.36	0.60	0.92	1.30	1.74	0.38	0.63	0.92	1.25	1.65	0.42	0.67	0.94	1.26	1.61
	1	0.36	0.60	0.92	1.31	1.77	0.38	0.63	0.92	1.25	1.65	0.42	0.67	0.94	1.27	1.62
	2	0.36	0.60	0.92	1.30	1.74	0.38	0.63	0.92	1.25	1.65	0.42	0.67	0.94	1.26	1.61
	3	0.36	0.60	0.91	1.30	1.74	0.38	0.63	0.93	1.25	1.64	0.42	0.67	0.94	1.27	1.62
	4	0.36	0.60	0.91	1.33	2.09	0.38	0.63	0.93	1.25	1.66	0.42	0.67	0.94	1.27	1.62
	5	0.36	0.60	0.91	1.37	2.17	0.38	0.63	0.93	1.25	1.64	0.42	0.67	0.94	1.27	1.62
	6	0.36	0.60	0.96	1.40	2.09	0.38	0.63	0.93	1.25	1.72	0.42	0.67	0.96	1.27	1.61

*100-cow herd, 3.5% butterfat milk. See appendix for feeds in selected feeding programs.
†Run 0—all feeds; Run 1—no feed #15, 16; Run 2—no feed #2; Run 3—no feed #2, 3; Run 4—no feed #2, 3, 5; Run 5—no feed #2, 3, 5, 10, 11; Run 6—no feed #2, 3, 5, 15, 16.

available in the feed program. In all cases, alfalfa hay or silage was found to be an important feed in the ration, along with corn silage.

At the high feed cost levels, the restriction of no-shelled corn in the feed program increased daily feed costs significantly at milk production levels above 75 lb. per day (40% increase for a 1200 lb. cow and 10% to 30% for 1400 lb. and 1600 lb. cows).

Cow Size

Larger cow sizes did not mean higher feeding costs. Below 50 lb. per day, the 1200 lb. cow had the lowest daily costs. Above 50 lb., the 1400 and 1600 lb. cows gave the lowest costs. These results are given in Table 2.

Butterfat Test

Butterfat test (BF) greatly affected daily feed cost and cost per cwt. of milk. For a 1200 lb. cow producing 2.5% BF milk, a production level of 75-100 lb. per day gave the lowest cost per cwt. Above 3.5% BF, a production level of 50-75 lb. per day resulted in the lowest cost per cwt. For a 1600 lb. cow producing 2.5 to 4.5% BF milk, a daily production of 75-100 lb. per day resulted in the lowest feed cost per cwt. Table 3 contains daily feed costs at various BF levels.

Herd Size

Herd size was found to have little effect on feed selection and feed costs per day above the 34-cow herd size. Between the 20 and 34-cow herd, significant differences in daily feed costs were predicted at fixed milk production levels. Table 4 contains the results for different herd sizes.

Milk Production

As milk production increased, feed costs per day increased but feed costs per cwt. of milk produced decreased until the dairy animal was producing about 75 lb. of milk per day. Above 75 lb. of milk, feed

TABLE 3.—Daily Cost of Selected Rations for Different Butterfat Percentages.*

Cow Size, Lb.		1200					1400					1600				
Milk Production		0	25	50	75	100	0	25	50	75	100	0	25	50	75	100
Cost	Butterfat Percent	Daily Cost $/Cow/Day					Daily Cost $/Cow/Day					Daily Cost $/Cow/Day				
L	2.5	0.24	0.34	0.44	**0.66**	0.90	0.25	0.35	0.46	**0.63**	0.87	0.28	0.36	0.48	**0.60**	0.83
L	3.5	0.24	0.35	**0.51**	0.79	1.09	0.25	0.36	**0.50**	**0.75**	1.02	0.28	0.38	0.52	**0.72**	0.99
L	4.5	0.24	0.37	**0.58**	0.91	1.50	0.25	0.38	**0.55**	0.87	1.19	0.28	0.40	**0.56**	**0.84**	1.16
H	2.5	0.29	0.45	0.63	0.85	**1.07**	0.31	0.48	0.66	0.85	**1.08**	0.34	0.51	0.67	0.87	**1.08**
H	3.5	0.29	0.48	0.70	**0.97**	1.32	0.31	0.51	0.72	0.97	**1.25**	0.34	0.54	0.75	0.98	**1.25**
H	4.5	0.29	0.53	0.79	**1.09**	2.15	0.31	0.54	0.80	1.09	**1.43**	0.34	0.57	0.82	1.11	**1.42**
M	2.5	0.36	0.56	0.81	**1.08**	1.45	0.38	0.60	0.82	1.10	**1.37**	0.42	0.63	0.85	1.10	**1.40**
M	3.5	0.36	0.60	0.92	**1.30**	**1.74**	0.38	0.63	0.92	1.25	**1.65**	0.42	0.67	0.94	1.26	**1.61**
M	4.5	0.36	0.65	1.02	**1.49**	2.43	0.38	0.67	1.03	1.44	**1.89**	0.42	0.72	1.04	1.44	**1.86**

*100-cow herd. Minimum feed cost per cwt. of milk in bold face type.

TABLE 4.—Daily Cost of Selected Rations for Different Herd Sizes.*

Cow Size, Lb.		1200 Lb.					1400 Lb.					1600 Lb.				
Milk Production		0	25	50	75	100	0	25	50	75	100	0	25	50	75	100
Cost	Herd Size	Daily Cost $/Cow/Day					Daily Cost $/Cow/Day					Daily Cost $/Cow/Day				
L	20	0.25	0.46	0.66	0.98	1.31	0.27	0.49	0.66	0.89	1.14	0.30	0.51	0.65	0.90	1.15
L	34	0.24	0.41	0.63	0.91	1.19	0.26	0.45	0.62	0.86	1.10	0.29	0.45	0.59	0.87	1.13
L	67	0.24	0.37	0.53	0.84	1.11	0.25	0.38	0.52	0.77	1.04	0.28	0.40	0.54	0.74	1.02
L	100	0.24	0.35	0.51	0.79	1.09	0.25	0.36	0.50	0.75	1.02	0.28	0.38	0.52	0.72	0.99
H	20	0.31	0.57	0.79	1.12	1.50	0.33	0.59	0.81	1.04	1.33	0.36	0.62	0.82	1.07	1.34
H	34	0.30	0.51	0.75	1.04	1.41	0.32	0.55	0.77	1.00	1.29	0.35	0.59	0.78	1.03	1.30
H	67	0.29	0.49	0.71	0.99	1.35	0.31	0.52	0.73	0.98	1.26	0.35	0.55	0.76	0.99	1.26
H	100	0.29	0.48	0.70	0.97	1.32	0.31	0.51	0.72	0.97	1.25	0.35	0.54	0.75	0.98	1.25
M	20	0.38	0.68	1.01	1.47	1.93	0.40	0.72	1.01	1.34	1.73	0.44	0.76	1.03	1.34	1.76
M	34	0.37	0.65	0.97	1.40	1.83	0.39	0.68	0.96	1.29	1.71	0.43	0.72	0.98	1.30	1.70
M	67	0.36	0.61	0.93	1.33	1.76	0.38	0.65	0.93	1.26	1.67	0.42	0.69	0.95	1.27	1.64
M	100	0.36	0.60	0.92	1.30	1.74	0.38	0.63	0.92	1.25	1.65	0.42	0.67	0.97	1.26	1.61

*3.5% butterfat milk

TABLE 5.—Cost per cwt. of Milk of Selected Feeding Programs.*

Run	1200 Lb. Cow Daily Cost for Given Milk Production—$/cwt.					1400 Lb. Cow Daily Cost for Given Milk Production—$/cwt.					1600 Lb. Cow Daily Cost for Given Milk Production—$/cwt.				
	0	25	50	75	100	0	25	50	75	100	0	25	50	75	100
L		1.41	1.02	1.05	1.09		1.46	1.00	1.00	1.02		1.53	1.04	0.96	0.99
H		1.91	1.40	1.29	1.32		2.03	1.44	1.29	1.25		2.15	1.49	1.31	1.25
M		2.38	1.84	1.74	1.74		2.53	1.83	1.67	1.65		2.69	1.88	1.68	1.61

*100-cow herd size, 3.5 % butterfat.

costs per cwt. increased. Results are given in Table 5 for the computer runs L, H, and M.

Costs were calculated for two different feeding programs (Table 6). These programs were: 1) feed the same ration throughout the year, and 2) feed the cow according to milk production. The costs per pound of milk for these different feeding schedules indicate that milk production level and feeding schedule can reduce feed costs greatly. These results for the two feeding programs give the maximum and minimum possible cost values as milk production increases.

There is another advantage in feeding for and achieving maximum production. That is minimizing waste. In the analysis, estimates of dry matter waste in chosen rations were calculated and found to be nearly a constant for a given cow size. Thus a cow giving 40 lb. of milk per day would produce as much waste as a cow giving 70-100 lb. of milk per day. Estimates of daily waste per pound of milk produced are shown in Figure 5.

The effect of increased milk production on herd health problems is not quantitized at the present time. It seems plausible that as milk production increases, herd health problems will increase, but how much is not known. Under any given management system it would appear that housing, milking procedure, or other environmental factors could become more important than the feeding program in trying to optimize returns from a milk production unit.

TABLE 6.—Cost per cwt. of Milk for Two Feeding Schedules, 1400 Lb. Cow Size, High Feed Cost, Run 0.

Peak Daily Production	305-Day Production*	Feed Same Throughout Lactation $/cwt.	Feed According to Production $/cwt.
25	5,994	3.12	2.78
50	11,988	2.12	1.84
75	17,982	1.80	1.55
100	23,976	1.72	1.42

*Production = A exp. (— .00166T), where T is time in days and A is maximum daily production (1). Herd size=100 cows.

Constraints

Sensitivity of the results to variations in constraints were calculated for each of the test runs. It was found that in the selected feeding programs, nondigestible dry matter, digestible energy, and phosphorus were the restrictions controlling the feeding program. Above 60 lb. of milk per day, total protein also became important. The results were not affected by minor changes in calcium levels.

SUMMARY

The feeding programs selected in this analysis do not apply to all Ohio dairymen as they apply only for the cost assumptions used in the analysis. Each dairyman needs to have his own feed analyzed, estimate his own costs of storage and feeding, and then have an analysis made of his own data to determine the two or three best alternatives fitting his situation. Such an approach allows the dairyman to evaluate his present system and also to test changes in his current feeding system by predicting what the results would be if he changed. For example, optimizing feed costs using no constraints on present storage structures could point out the need for additional types of storage.

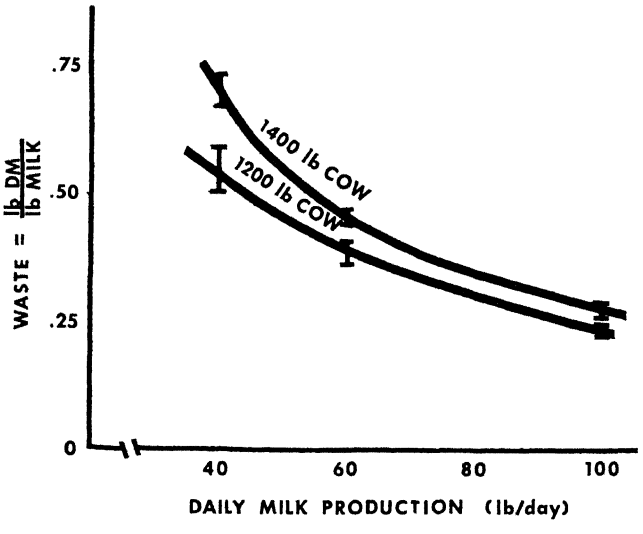

FIG. 5.—Waste output vs. milk production for selected feeding programs.

As given in the Appendix, these rations supply the required nutrients without exceeding NPN requirements, or providing less than 8 lb. of fiber per day in the ration. In some instances, digestive disturbances may arise due to the amounts and conditions under which grain would be fed. The results indicate the following:

1. Alfalfa hay or silage is an important feed in formulating low cost feeding programs for high milk production levels.
2. Shelled corn is an important feed in formulating low cost feeding programs for high milk production levels.
3. No single feeding program was found to give lowest cost. Many variations in types of feeds and storage were feasible for each herd size and milk production level, with no significant cost differences between them.
4. With more than 34 cows, herd size has little effect on the type of feeding program selected or daily feed cost.
5. The inclusion of urea in the grain concentrate (1% level) or corn silage (10 lb. per ton, wet basis) did not significantly affect feed costs when alfalfa hay (or silage) contained at least 17% protein. When hay quality was limited to 13.5% protein, daily costs increased 0 to 9¢ per cow per day if urea was not fed in the ration.

REFERENCES

1. Brody, S. 1945. Bioenergetics and growth. Reinhold Pub. Corp., New York, N.Y.
2. Conrad, H. R., J. W. Hibbs, and J. R. Staubus. 1969. Guidelines for increasing urea utilization in rations for dairy cows. Ohio Agri. Res. and Dev. Center, Res. Bull. 1018.
3. Conrad, H. R. and J. W. Hibbs. 1968. Nitrogen utilization by the ruminant. Appreciation of its nutritive value. J. Dairy Sci., 51: 276.
4. Conrad, H. R. 1966. Symposium on factors influencing the voluntary intake of herbage by ruminants: Physiological and physical factors limiting feed intake. J. Anim. Sci., 25:227.
5. Corn harvesting and handling in Ohio. Coop. Ext. Serv., The Ohio State Univ., Columbus, Bull. 502, 1968.
6. Gist, G. *et al.* 1966. Crops of silage. Coop. Ext. Serv., The Ohio State Univ., Columbus, L-104.
7. Hoglund, C. R. 1967. Economic considerations in selecting silage storage and feeding systems. Michigan State Univ., East Lansing, Agri. Econ. Report 84.
8. Howard, W. T. *et al.* 1968. Least cost complete rations for dairy cows. J. Dairy Sci., 51: 595.
9. Hundtoft, E. B. 1965. Handling hay crops. Cornell Univ., Ithaca, N.Y., Agri. Eng. Ext. Bull. 366.
10. Keener, H. M. and H. R. Conrad. 1970. Selection of a feeding program for dairy cows. Ohio Agri. Res. and Dev. Center, Res. Summary 45, p. 13.
11. McCullough, M. E. 1969. Optimum feeding of dairy animals. Univ. of Georgia Press, Athens.
12. Miskell, D. R. and E. T. Shaudys. 1968. Crop production costs in Ohio. Ohio Agri. Res. and Dev. Center, Ohio Report, 53 (5):71.
13. Morrison, F. B. 1956. Feeds and feeding. Morrison Pub. Co., Ithaca, N.Y., 22nd Edition.
14. Nutrient requirements of dairy cattle. National Academy of Sciences, National Research Council, Fourth Edition, 1971.
15. Shaudys, E. T. and G. R. Prigge. 1970. The cost of producing major field crops in Ohio. Amer. Soc. of Agri. Eng., St. Joseph, Mich., ASAE Paper No. 70-124.
16. Wagner, D. G. and J. K. Loosli. 1967. Studies on the energy requirements of high producing dairy cows. Cornell Univ. Exp. Sta., Ithaca, N.Y., Memoir 400.
17. Wendling, L. T., *et al.* 1964. Planning feed handling systems. Ext. Serv., Kansas State Univ., Manhattan, C. 322.
18. Whisler, Marshall K. 1968. Silage economics. Ohio Coop. Ext. Serv., Wooster Area Extension Farm Management Report.
19. Agricultural prices 1970. U. S. Dept. of Agr. Crop Reporting Board, Statistical Reporting Service, Washington, D. C.

APPENDIX

APPENDIX TABLE I.—Cost of Storing and Feeding Crops.*

Feed Item	Feed System	Storage Loss	Fix Labor	Var Labor	Fix Equip	Var Equip	Fix Stor	Var Stor	Fix Power	Var Power
			Hr./Yr.	Hr./Ton	$	$/Ton	$	$/Ton	$/Yr.	$/Ton
2 Alf Hay	S4	.02	12.	.833			900.	20.00		
3 Alf Hay	S4	.02								
4 Alf Hay	S4	.02								
5 Alf Sil	S5	.10	59.	.200	1740.	5.36	488.	37.50	5.60	0.0945
6 Cor Sil	S5	.08	48.	.153	1740.	5.36	488.	37.50	4.70	0.0739
7 Cor Sil	S6	.14	83.	.083	1133.	5.02	3333.	6.77	80.00	0.1250
8 Cor Ear	S2	.01	30.	.100	2500.		560.	10.60		0.1416
9 Cor Ear	S5	.04	48.	.153	1400.	5.73	875.	24.83	4.70	0.0739
10 Cor Grain	S2	.01	30.	.100	2500.		560.	10.60		0.1416
11 Cor Grain	S5	.04	48.	.153	1400.	5.73	900.	21.83	4.70	0.0739
12 Wheat	S2	.01	30.	.100	2500.		560.	10.60		0.1416
13 Soybean, Seed	S2	.01	30.	.100	2500.		560.	10.60		0.1416
14 Soybean Meal	S1	.01					200.	0.98		0.0118
15 Urea, G	Grain									
16 Urea, S	Silage									
17 Dical Phos	Grain									
18 Salt	Grain									

*Labor cost $2.50/hr., equipment budgeted at $0.176 per year, storage budgeted at $0.15 per year (references 5, 7, 9, 17, 18).

APPENDIX TABLE II.—Cost of Feeds in Ohio.

Feed Item	Crop Production Cost*		Prices Paid to Farmers for Crops, 1970† Av.	Std. Dev.	Low	High
	$/Cwt.	$/Cwt.	$/Cwt.	$/Cwt.	$/Cwt.	$/Cwt.
Wheat	1.96 -3.86	1.97 -3.25	2.40	0.165	2.18	2.70
Corn, Shelled	1.21 -2.17	1.32 -2.25	2.27	0.148	2.07	2.52
Corn, Ear	0.97 -1.74					
Oats	1.96 -4.78		2.13	0.144	2.03	2.47
Soybeans	3.06 -5.78	2.52 -4.38	4.39	0.270	3.95	4.82
All Hay	0.997-2.044		1.24	0.034	1.20	1.31
Alfalfa Hay			1.38	0.023	1.35	1.43
Clover Timothy Hay			1.16	0.031	1.13	1.23
Grass Silage	0.38 -0.463‡					
Corn Silage	0.290-0.51	0.242-0.373				

*References 12 and 15.
†Reference 19.
‡Reference 6.

APPENDIX TABLE III.—Nutrient Value, Cost of Feeds Used in Analysis.

Feed	Item	Stor System	Cost L	Cost H	Cost M	Dry Matter	Non-Dig Dry Mat	Fiber Content	Dig Energy	Total Protein	NPN	Ca	Ph	Salt
			$/lb	$/lb	$/lb									
2	Alfalfa Hay	S4	0.0090	0.0135	0.0157	1.000	0.4000	0.2629	1.1000	0.2200	0.0001	0.0174	0.0024	0
3	Alfalfa Hay	S4	0.0075	0.0112	0.0140	1.000	0.4400	0.3034	1.0600	0.1800	0.0001	0.0161	0.0024	0
4	Alfalfa Hay	S4	0.0075	0.0100	0.0129	1.000	0.3900	0.3393	1.0600	0.1360	0.0001	0.0128	0.0024	0
5	Alfalfa Silage	S5	0.0070	0.0140	0.0150	1.000	0.3750	0.3033	1.1367	0.1767	0.0127	0.0160	0.0038	0
6	Corn Silage	S5	0.0069	0.0138	0.0150	1.000	0.3180	0.2172	1.3828	0.0793	0.0002	0.0024	0.0021	0
7	Corn Silage	S6	0.0069	0.0138	0.0150	1.000	0.3180	0.2172	1.3828	0.0793	0.0062	0.0024	0.0021	0
8	Corn, Ear	S2	0.0149	0.0169	0.0223	1.000	0.2200	0.0512	1.6988	0.0860		0.0004	0.0026	0
9	Corn, Ear	S5	0.0120	0.0149	0.0223	1.000	0.2200	0.0512	1.6988	0.0860	0.0004	0.0004	0.0025	0
10	Corn, Grain	S2	0.0164	0.0191	0.0269	1.000	0.1100	0.0258	1.8213	0.1000		0.0002	0.0035	0
11	Corn, Grain	S5	0.0147	0.0164	0.0269	1.000	0.1100	0.0258	1.8213	0.1000	0.0004	0.0002	0.0033	0
12	Wheat	S2	0.0220	0.0360	0.0257	1.000	0.1400	0.0303	1.7539	0.1461		0.0006	0.0045	0
13	Soybean, Seed	S2	0.0310	0.0546	0.0513	1.000	0.1100	0.0560	1.8800	0.4210		0.0159	0.0053	0
14	Soybean, Meal	S1	0.0600	0.0600	0.0600	1.000	0.1400	0.0644	1.7122	0.4867		0.0300	0.0070	0
15	Urea	S1	0.0553	0.0553	0.0553	1.000	0.0020			2.95	0.4737			
16	Dicalcium Phosphate	S1	0.0677	0.0677	0.0677	1.000	0.0020					0.2760	0.2135	0
17	Salt	S1	0.1000	0.1000	0.1000	1.000	0.0020							1.0

APPENDIX TABLE IV.—Selected Feeding Program, Run L. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	26.5	0.0	18.9	0.0	24.0	7.5
3 ALF HAY	0.0	20.7	25.3	8.6	0.0	0.0	28.5	24.5	27.4	0.0	0.0	22.0	16.5	0.0	22.8
4 ALF HAY	22.0	0.0	0.0	0.0	0.0	23.5	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	11.4	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	11.9	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	31.4	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	0.0	0.0	0.0	0.0	0.0	33.0	0.0
10 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	16.3	27.7	37.4	0.0	0.0	0.0	27.5	39.4	0.0	0.0	0.0	0.0	38.3
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
17 DI CAL	0.00	0.10	0.13	0.11	0.05	0.00	0.07	0.19	0.18	0.23	0.00	0.03	0.22	0.28	0.22
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.25	0.45	0.66	0.98	1.31	0.26	0.48	0.66	0.89	1.14	0.29	0.50	0.65	0.90	1.15
COST $/CWT	0.00	1.82	1.32	1.30	1.31	0.00	1.95	1.32	1.18	1.14	0.00	2.02	1.30	1.20	1.15

APPENDIX TABLE V.—Selected Feeding Program, Run L. Herd Size = 100. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	1.5	3.5	0.0	0.0	0.0	0.0	7.5	11.4	0.0	0.0	0.0	0.0	10.4
3 ALF HAY	0.0	14.1	0.0	0.0	0.0	0.0	10.9	4.6	0.0	0.0	0.0	7.7	4.0	0.0	0.0
4 ALF HAY	22.0	0.0	0.0	0.0	0.0	23.5	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	0.0	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	17.0	38.4	30.1	0.0	0.0	21.5	38.8	33.5	22.2	0.0	26.0	41.2	53.2	32.6
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	15.8	38.1	0.0	0.0	0.0	12.9	31.6	0.0	0.0	0.0	0.0	24.8
11 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.7	1.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0
14 SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.00	0.17	0.14	0.00	0.00	0.00	0.12	0.31	0.00	0.00	0.00	0.03	0.24
16 UREA,S	0.00	0.00	0.60	0.47	0.00	0.00	0.05	0.60	0.52	0.34	0.00	0.20	0.64	0.71	0.50
17 DI CAL	0.00	0.12	0.26	0.34	0.03	0.00	0.13	0.26	0.29	0.27	0.00	0.15	0.26	0.33	0.31
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.23	0.35	0.50	0.79	1.08	0.25	0.36	0.50	0.74	1.01	0.27	0.38	0.52	0.71	0.99
COST $/CWT	0.00	1.40	1.01	1.05	1.08	0.00	1.45	1.00	0.99	1.01	0.00	1.52	1.04	0.95	0.99

APPENDIX TABLE VI.—Selected Feeding Program, Run 2L. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 ALF HAY	0.0	20.7	25.3	13.3	0.0	0.0	28.5	24.5	27.4	23.9	0.0	36.2	16.5	27.6	29.4
4 ALF HAY	22.0	0.0	0.0	0.0	0.0	23.5	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	10.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	11.9	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	4.1	31.4	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	0.0	0.0	0.0	0.0	0.0	16.4	0.0
10 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.5	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	16.3	27.6	37.4	0.0	0.0	0.0	27.5	0.0	0.0	0.0	0.0	13.5	38.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
15 UREA,G	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00
16 UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
17 DI CAL	0.00	0.10	0.13	0.11	0.05	0.00	0.07	0.19	0.18	0.19	0.00	0.04	0.22	0.22	0.21
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.25	0.45	0.66	0.98	1.31	0.26	0.48	0.66	0.89	1.13	0.29	0.52	0.65	0.96	1.16
COST $/CWT	0.00	1.82	1.32	1.31	1.31	0.00	1.95	1.32	1.18	1.13	0.00	2.08	1.30	1.28	1.16

APPENDIX TABLE VII.—Selected Feeding Program, Run 2L. Herd Size = 100. Herd Butterfat Test = 3.50.

COW SIZE,LBS		1200.					1400.					1600.			
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 ALF HAY	0.0	14.1	0.0	4.6	0.0	0.0	10.9	4.8	0.0	23.9	0.0	7.7	4.0	0.0	7.9
4 ALF HAY	22.0	0.0	0.0	0.0	0.0	23.5	0.0	0.0	0.0	0.0	26.1	0.0	0.0	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	0.0	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	17.0	39.2	27.8	0.0	0.0	21.5	38.4	44.3	0.0	0.0	26.0	41.2	53.3	34.8
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	16.7	38.1	0.0	0.0	0.0	0.0	41.5	0.0	0.0	0.0	0.0	22.6
11 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	1.2	1.8	2.2	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	2.9	1.9
14 SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.01	0.18	0.14	0.00	0.00	0.00	0.03	0.31	0.00	0.00	0.00	0.02	0.24
16 UREA,S	0.00	0.00	0.61	0.43	0.00	0.00	0.05	0.60	0.69	0.00	0.00	0.20	0.64	0.74	0.54
17 DI CAL	0.00	0.12	0.28	0.29	0.03	0.00	0.13	0.26	0.38	0.19	0.00	0.15	0.26	0.34	0.31
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.23	0.35	0.51	0.79	1.08	0.25	0.36	0.50	0.75	1.04	0.27	0.38	0.52	0.71	1.01
COST $/CWT	0.00	1.40	1.02	1.06	1.08	0.00	1.45	1.00	1.00	1.04	0.00	1.52	1.04	0.95	1.01

APPENDIX TABLE VIII.—Selected Feeding Program, Run 4L. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS		1200.					1400.					1600.			
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 ALF HAY	22.0	24.9	22.3	0.0	0.0	23.5	22.7	0.0	24.1	20.9	26.1	28.8	9.1	29.1	25.9
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	34.9	30.1	0.0	12.5	45.4	0.0	0.0	0.0	9.8	37.1	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	6.6	17.7	13.7	0.0	0.0	0.0	0.0	28.1	40.8	0.0	0.0	0.0	26.3	39.0
11 COR,GRA	0.0	0.0	0.0	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.3	2.4	0.0	0.0	0.0	0.0	1.1	2.4	0.0	0.0	0.0	0.7	1.9
15 UREA,G	0.00	0.00	0.18	0.13	0.00	0.00	0.00	0.00	0.29	0.43	0.00	0.00	0.00	0.27	0.41
16 UREA,S	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.58	0.00	0.00
17 DI CAL	0.00	0.06	0.12	0.35	0.14	0.00	0.09	0.32	0.14	0.15	0.00	0.07	0.24	0.15	0.16
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.25	0.49	0.69	1.01	1.45	0.26	0.48	0.65	0.96	1.24	0.29	0.51	0.66	0.95	1.23
COST $/CWT	0.00	1.96	1.39	1.35	1.45	0.00	1.92	1.31	1.28	1.24	0.00	2.04	1.33	1.27	1.23

APPENDIX TABLE IX.—Selected Feeding Program, Run 4L. Herd Size = 100. Herd Butterfat Test = 3.50.

COW SIZE,LBS		1200.					1400.					1600.			
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 ALF HAY	22.0	11.2	0.0	0.0	0.0	23.5	8.6	4.5	0.0	0.0	26.1	6.1	9.1	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	19.3	39.2	35.3	30.1	0.0	23.3	40.5	44.4	38.6	0.0	27.2	37.1	53.3	47.6
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	0.0	21.6	0.0	0.0	0.0	0.0	15.2
11 COR,GRA	0.0	0.0	0.0	0.0	8.6	0.0	0.0	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	1.2	3.1	22.0	0.0	0.0	0.0	3.0	4.1	0.0	0.0	0.0	2.9	3.9
14 SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.01	0.15	0.00	0.00	0.00	0.00	0.03	0.25	0.00	0.00	0.00	0.00	0.19
16 UREA,S	0.00	0.20	0.61	0.52	0.00	0.00	0.27	0.63	0.69	0.56	0.00	0.35	0.58	0.77	0.70
17 DI CAL	0.00	0.13	0.28	0.43	0.14	0.00	0.14	0.24	0.38	0.59	0.00	0.15	0.24	0.34	0.55
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.23	0.35	0.51	0.78	1.23	0.25	0.37	0.51	0.75	1.03	0.27	0.38	0.52	0.71	1.00
COST $/CWT	0.00	1.41	1.02	1.05	1.23	0.00	1.47	1.03	1.00	1.03	0.00	1.54	1.05	0.95	1.00

APPENDIX TABLE X.—Selected Feeding Program, Run H. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 ALF HAY	0.0	0.0	12.2	13.3	0.0	0.0	0.0	0.0	26.2	23.9	0.0	0.0	0.0	26.7	29.4
4 ALF HAY	22.0	22.5	11.5	0.0	0.0	23.5	27.6	27.1	0.0	0.0	26.1	32.7	31.8	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	10.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	8.6	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	0.0	41.5	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	17.1	27.6	37.4	0.0	0.0	0.0	28.3	0.0	0.0	0.0	14.8	29.2	38.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.9
15 UREA,G	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.12	0.00	0.31	0.00	0.00	0.00	0.00	0.00
16 UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 DI CAL	0.00	0.09	0.14	0.11	0.05	0.00	0.08	0.12	0.18	0.19	0.00	0.06	0.12	0.18	0.21
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.31	0.55	0.79	1.11	1.50	0.32	0.58	0.81	1.04	1.33	0.36	0.62	0.82	1.06	1.34
COST $/CWT	0.00	2.20	1.58	1.48	1.50	0.00	2.35	1.62	1.38	1.33	0.00	2.49	1.64	1.42	1.34

APPENDIX TABLE XI.—Selected Feeding Program, Run H. Herd Size = 100. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	18.0	0.0	0.0	0.0	0.0	7.5
3 ALF HAY	0.0	0.0	12.2	8.6	0.0	0.0	0.0	6.9	26.2	7.9	0.0	0.0	1.2	20.3	22.8
4 ALF HAY	22.0	22.2	11.5	0.0	0.0	23.5	21.9	21.0	0.0	0.0	26.1	22.0	30.8	11.2	0.0
5 ALF SIL	0.0	0.0	0.0	11.4	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0
9 COR,EAR	0.0	8.8	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	17.1	27.7	26.0	0.0	0.0	15.8	28.3	40.0	0.0	0.0	14.8	25.6	38.3
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 DI CAL	0.00	0.10	0.14	0.11	0.06	0.00	0.10	0.13	0.18	0.23	0.00	0.09	0.12	0.18	0.22
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.29	0.47	0.70	0.97	1.31	0.31	0.50	0.72	0.96	1.24	0.34	0.54	0.74	0.98	1.25
COST $/CWT	0.00	1.91	1.40	1.29	1.31	0.00	2.02	1.44	1.29	1.24	0.00	2.16	1.49	1.30	1.25

APPENDIX TABLE XII.—Selected Feeding Program, Run 2H. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0	0.0	0.0	7.5
3 ALF HAY	0.0	0.0	12.2	13.3	0.0	0.0	0.0	0.0	26.2	0.0	0.0	0.0	0.0	26.7	22.8
4 ALF HAY	22.0	22.5	11.5	0.0	0.0	23.5	27.6	27.1	0.0	0.0	26.1	32.7	31.8	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	10.5	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 COR,EAR	0.0	8.6	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	17.1	27.7	37.4	0.0	0.0	0.0	28.3	39.4	0.0	0.0	14.8	29.2	38.3
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 SB,SEED	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.6	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
15 UREA,G	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 DI CAL	0.00	0.09	0.14	0.11	0.05	0.00	0.08	0.12	0.18	0.23	0.00	0.06	0.12	0.18	0.22
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.31	0.55	0.79	1.11	1.50	0.32	0.58	0.81	1.04	1.33	0.36	0.62	0.82	1.06	1.34
COST $/CWT	0.00	2.20	1.58	1.49	1.50	0.00	2.35	1.62	1.38	1.33	0.00	2.49	1.64	1.42	1.34

APPENDIX TABLE XIII.—Selected Feeding Program, Run 2H. Herd Size = 100. Herd Butterfat Test = 3.50.

	COW SIZE,LBS	1200.					1400.					1600.				
	MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
	DAILY RATION,LBS,DRY MATTER BASIS															
2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	ALF HAY	0.0	0.0	12.2	0.0	0.0	0.0	0.0	6.9	26.2	0.0	0.0	0.0	1.2	20.3	0.0
4	ALF HAY	22.0	22.2	11.5	0.0	0.0	23.5	21.9	21.0	0.0	0.0	26.1	22.0	30.8	11.2	0.0
5	ALF SIL	0.0	0.0	0.0	27.2	22.7	0.0	0.0	0.0	0.0	29.6	0.0	0.0	0.0	0.0	35.7
6	COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0
9	COR,EAR	0.0	8.8	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	COR,GRA	0.0	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	17.6	0.0	0.0	0.0	0.0	0.0
11	COR,GRA	0.0	0.0	17.1	24.9	25.7	0.0	0.0	15.8	28.3	18.7	0.0	0.0	14.8	25.6	32.8
12	WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	SB,SEED	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	UREA,G	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00
16	UREA,S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	DI CAL	0.00	0.10	0.14	0.02	0.06	0.00	0.10	0.13	0.18	0.03	0.00	0.09	0.12	0.18	0.01
18	SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
	COST $/DAY	0.29	0.47	0.70	0.94	1.31	0.31	0.50	0.72	0.96	1.24	0.34	0.54	0.74	0.98	1.22
	COST $/CWT	0.00	1.91	1.40	1.26	1.31	0.00	2.02	1.44	1.29	1.24	0.00	2.16	1.49	1.30	1.22

APPENDIX TABLE XIV.—Selected Feeding Program, Run 4H. Herd Size = 20. Herd Butterfat Test = 3.50.

	COW SIZE,LBS	1200.					1400.					1600.				
	MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
	DAILY RATION,LBS,DRY MATTER BASIS															
2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	ALF HAY	22.0	22.5	22.3	0.0	0.0	23.5	27.6	27.1	24.1	20.9	26.1	32.7	31.8	29.1	25.9
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	COR SIL	0.0	0.0	0.0	34.7	30.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	COR,EAR	0.0	8.6	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0
10	COR,GRA	0.0	0.0	17.7	0.0	0.0	0.0	0.0	16.4	28.1	40.8	0.0	0.0	0.0	26.3	39.1
11	COR,GRA	0.0	0.0	0.0	13.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8	0.0	0.0
12	WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	SB,SEED	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	SB,MEAL	0.0	0.0	0.3	3.2	0.0	0.0	0.0	0.0	1.1	2.4	0.0	0.0	0.1	0.7	1.9
15	UREA,G	0.00	0.00	0.18	0.03	0.00	0.00	0.00	0.12	0.29	0.43	0.00	0.00	0.00	0.27	0.41
16	UREA,S	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	DI CAL	0.00	0.09	0.12	0.26	0.14	0.00	0.08	0.12	0.14	0.15	0.00	0.06	0.12	0.15	0.16
18	SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
	COST $/DAY	0.31	0.55	0.80	1.31	2.22	0.32	0.58	0.81	1.10	1.40	0.36	0.62	0.82	1.10	1.40
	COST $/CWT	0.00	2.20	1.61	1.75	2.22	0.00	2.35	1.62	1.47	1.40	0.00	2.49	1.64	1.47	1.40

APPENDIX TABLE XV.—Selected Feeding Program, Run 4H. Herd Size = 100. Herd Butterfat Test = 3.50.

	COW SIZE,LBS	1200.					1400.					1600.				
	MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
	DAILY RATION,LBS,DRY MATTER BASIS															
2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	ALF HAY	22.0	22.2	22.3	2.6	0.0	23.5	21.9	27.1	24.1	20.9	26.1	22.0	31.8	29.1	25.9
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	COR SIL	0.0	0.0	0.0	30.1	30.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	0.0	0.0
9	COR,EAR	0.0	8.8	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	COR,GRA	0.0	0.0	17.7	16.1	0.0	0.0	0.0	16.4	28.1	40.8	0.0	0.0	0.0	26.3	39.1
11	COR,GRA	0.0	0.0	0.0	0.0	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8	0.0	0.0
12	WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	SB,SEED	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	SB,MEAL	0.0	0.0	0.3	2.1	0.0	0.0	0.0	0.0	1.1	2.4	0.0	0.0	0.1	0.7	1.9
15	UREA,G	0.00	0.00	0.18	0.18	0.00	0.00	0.00	0.12	0.29	0.43	0.00	0.00	0.00	0.27	0.41
16	UREA,S	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	DI CAL	0.00	0.10	0.12	0.29	0.14	0.00	0.10	0.12	0.14	0.15	0.00	0.09	0.12	0.15	0.16
18	SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
	COST $/DAY	0.29	0.47	0.71	1.13	2.01	0.31	0.50	0.73	1.01	1.32	0.34	0.54	0.74	1.01	1.32
	COST $/CWT	0.00	1.91	1.43	1.51	2.01	0.00	2.02	1.46	1.35	1.32	0.00	2.16	1.49	1.35	1.31

APPENDIX TABLE XVI.—Selected Feeding Program, Run M. Herd Size = 20. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 ALF HAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.8	0.0	23.9	0.0	0.0	0.0	21.8	20.0
4 ALF HAY	22.0	16.5	22.3	0.0	0.0	23.5	22.7	0.0	21.5	0.0	26.1	28.8	26.4	0.0	0.0
5 ALF SIL	0.0	0.0	0.0	0.0	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	15.2	0.0	34.8	0.0	0.0	12.5	0.0	0.0	0.0	0.0	9.8	0.0	0.0	0.0
7 COR SIL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	0.0	0.0	0.0	0.0	19.5	34.7	22.8
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	17.6	13.8	38.1	0.0	0.0	0.0	0.0	41.5	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.4	0.0	0.0	0.0	0.0	0.0	24.4
13 SB,SEED	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.17	0.13	0.14	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.19	0.27	0.15
16 UREA,S	0.00	0.06	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 DI CAL	0.00	0.11	0.12	0.35	0.03	0.00	0.09	0.18	0.00	0.19	0.00	0.07	0.17	0.26	0.14
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.37	0.67	1.01	1.47	1.92	0.39	0.71	1.00	1.33	1.73	0.43	0.75	1.02	1.34	1.76
COST $/CWT	0.00	2.71	2.02	1.96	1.92	0.00	2.86	2.01	1.78	1.73	0.00	3.03	2.05	1.78	1.76

APPENDIX TABLE XVII.—Selected Feeding Program, Run M. Herd Size = 100. Herd Butterfat Test = 3.50.

COW SIZE,LBS	1200.					1400.					1600.				
MILK LB/DAY	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.	0.	25.	50.	75.	100.
DAILY RATION,LBS,DRY MATTER BASIS															
2 ALF HAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 ALF HAY	0.0	0.0	8.6	0.0	0.0	0.0	0.0	5.9	0.0	9.2	0.0	0.0	0.0	21.8	8.9
4 ALF HAY	22.0	22.5	7.7	0.0	0.0	23.5	21.9	15.9	21.5	0.0	26.1	22.0	26.4	0.0	9.9
5 ALF SIL	0.0	0.0	0.0	9.7	22.7	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0	0.0
6 COR SIL	0.0	0.0	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 COR SIL	0.0	0.0	0.0	20.2	0.0	0.0	0.0	0.0	0.0	9.9	0.0	0.0	0.0	0.0	0.0
8 COR,EAR	0.0	8.6	0.0	0.0	0.0	0.0	10.6	21.2	0.0	0.0	0.0	12.2	19.5	34.7	21.9
9 COR,EAR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 COR,GRA	0.0	0.0	0.0	6.4	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 COR,GRA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12 WHEAT	0.0	0.0	13.9	15.1	0.0	0.0	0.0	0.0	32.4	40.3	0.0	0.0	0.0	0.0	25.9
13 SB,SEED	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 SB,MEAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 UREA,G	0.00	0.00	0.00	0.07	0.14	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.19	0.27	0.32
16 UREA,S	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17 DI CAL	0.00	0.09	0.09	0.29	0.03	0.00	0.09	0.19	0.00	0.19	0.00	0.09	0.17	0.26	0.13
18 SALT	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20	0.05	0.09	0.13	0.16	0.20
COST $/DAY	0.35	0.59	0.91	1.30	1.73	0.38	0.63	0.91	1.25	1.64	0.42	0.67	0.93	1.25	1.61
COST $/CWT	0.00	2.38	1.83	1.73	1.73	0.00	2.53	1.83	1.66	1.64	0.00	2.68	1.87	1.67	1.61